Assistive Technology and Mild Disabilities
by Dave L. Edyburn

Until recently, little attention has been devoted to the assistive technology needs of students with mild disabilities. However, the federal mandate in the 1997 reauthorization of IDEA, to consider assistive technology when planning the IEP of every student, has been described as an event that marked the dawn of a new era of assistive technology for individuals with mild disabilities (Edyburn, 2005a, 2000).

The purpose of this article is to provide an introduction to the topic of assistive technology and students with mild disabilities. To set the context, we will begin by briefly examining the definitions, incidence, and characteristics associated with students with mild disabilities. Next, we consider the challenge of recognizing and responding to academic performance problems. Once we are motivated to act, we need to locate technology interventions that will enhance academic performance. However, the form and function of some forms of assistive technology will challenge our conceptions of technology enhanced performance. Finally, we will briefly discuss the process of assessing claims of technology enhanced performance.

Defining Mild Disabilities

Typically, mild disabilities are considered to be learning disabilities, emotional/behavioral disorders, and mental retardation. These disabilities are defined as follows in the IDEA '97 Final Regulations (§300.7 Child with a disability):

Learning Disabilities

(10) Specific learning disability is defined as follows: (i) General. The term means a disorder in one or more of the basic psychological processes involved in understanding or in using language, spoken or written, that may manifest itself in an imperfect ability to listen, think, speak, read, write, spell, or to do mathematical calculations, including conditions such as perceptual disabilities, brain injury, minimal brain dysfunction, dyslexia, and developmental aphasia. (ii) Disorders not included. The term does not include learning problems that are primarily the result of visual, hearing, or motor disabilities, of mental retardation, of emotional disturbance, or of environmental, cultural, or economic disadvantage. (Authority: 20 U.S.C. 1401(3)(A) and (B); 1401(26))

Emotional/Behavioral Disorders

(4) Emotional disturbance is defined as follows: (i) The term means a condition exhibiting one or more of the following characteristics over a long period of time and to a marked degree that adversely affects a child's educational performance: (A) An inability to learn that cannot be explained by intellectual, sensory, or health factors. (B) An inability to build or maintain satisfactory interpersonal relationships with peers and teachers. (C) Inappropriate types of behavior or feelings under normal circumstances. (D) A general pervasive mood of unhappiness or depression. (E) A tendency to develop physical symptoms or fears associated with personal or school problems. (ii) The term includes schizophrenia. The term does not apply to children who are socially maladjusted, unless it is determined that they have an emotional disturbance. (Authority: 20 U.S.C. 1401(3)(A) and (B); 1401(26))

Mental Retardation

(6) Mental retardation means significantly subaverage general intellectual functioning, existing concurrently with deficits in adaptive behavior and manifested during the developmental period, that adversely affects a child's educational performance. (Authority: 20 U.S.C. 1401(3)(A) and (B); 1401(26))

Incidence

Mild disabilities are high incidence disabilities. The most recent data available from the U.S. Department of Education (2002) indicate that the majority of students receiving special education services have mild disabilities (LD, ED/BD, MR):

These three categories of disabilities account for 68.8% of the students with disabilities ages 6-21 served under IDEA and represent over 3.9 million students.

The issue of high incidence disabilities represents a profound challenge to rethink assistive technology service delivery systems that were designed to provide assistive technology devices and services to low incidence populations (Edyburn, 2003a, 2000).

Characteristics of Mild Disabilities

One important characteristic of individuals with mild disabilities is that the disability is not visibly apparent. The nature of a "hidden dis-

Disability	# of students served	% of all students served
Specific learning disabilities	2,887,217	50.0%
Mental retardation	612,978	10.6%
Emotional disturbance	473,663	8.2%
Total	**3,973,858**	**68.8%**

Learn More About Technology and Mild Disabilities

Learning Disabilities	Emotional/Behavioral Disabilities	Mental Retardation
Ashton, T.M. (2005). Students with learning disabilities using assistive technology in the inclusive classroom. In D. Edyburn, K. Higgins, & R. Boone (Eds.), *Handbook of special education technology research and practice* (pp. 229-238). Whitefish Bay, WI: Knowledge by Design.	Fitzgerald, G. (2005). Using technologies to meet the unique needs of students with emotional/behavioral disorders: Findings and directions. In D. Edyburn, K. Higgins, & R. Boone (Eds.), *Handbook of special education technology research and practice* (pp. 335-354). Whitefish Bay, WI: Knowledge by Design.	Wehmeyer, M.L., Smith, S.J., & Davies, D.K. (2005). Technology use and students with intellectual disability: Universal design for all students. In D. Edyburn, K. Higgins, & R. Boone (Eds.), *Handbook of special education technology research and practice* (pp. 309-323). Whitefish Bay, WI: Knowledge by Design.
A Parent's Guide to Helping Kids with Learning Difficulties http://www.schwablearning.org	Behavior/Emotional Disability http://aimstar.knowbility.org/info_disabilities_behavioral.html	MR and DD Resources http://www.nekesc.k12.ks.us/ndd.html
LD Online http://www.ldonline.org/	SERI Behavior Disorders Resources http://seriweb.com/behavior.htm	AT and Mental Retardation http://www.sc.edu/scatp/mr.htm

ability" often results in misunderstandings where adults demand that a child simply "try harder" rather than understand the need to provide appropriate accommodations.

Meese (2001) summarizes the characteristics often associated with mild disabilities as follows: cognitive characteristics (intellectual ability, attentional deficits, memory and thinking skills); academic characteristics (reading, language arts, mathematics) and social-emotional characteristics (pp. 27-35). Students with mild disabilities are typically included in the general education classroom with some support services provided.
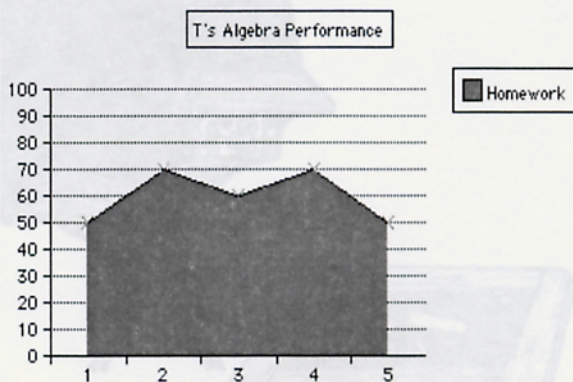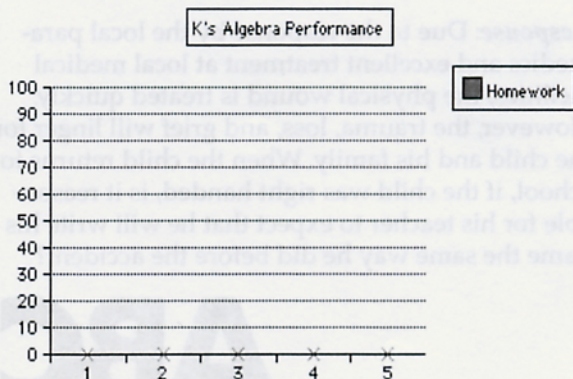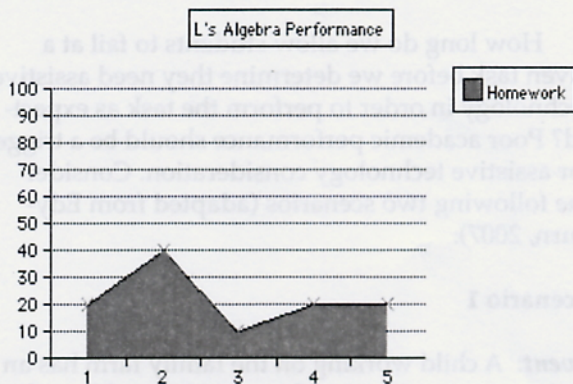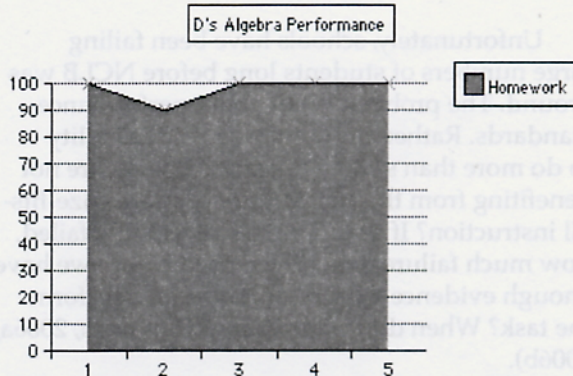
Academic Performance Problems

Given the impact of mild disabilities on cognitive functioning, it is essential that educators recognize the impact of a disability on academic performance in order to plan appropriate interventions. In this section, we examine three critical issues: recognizing an academic performance problem, identifying a trigger event, and calculating the remediation vs. compensation equation.

Recognizing an Academic Performance Problem

Schools routinely evaluate academic performance. Every classroom has extensive systems in place to identify failure, adequate performance, and exceptional performance. Consider the daily algebra homework scores of four ninth grade students in the Figures on the right. Which graph illustrates (a) a student who is successfully achieving? (b) a student that is non-engaged? (c) a student with inconsistent performance? (d) a consistently low performing student?

Rather than addressing the issues of poor performance, educators often search for reasons to explain poor performance, become sidetracked, and fail to intervene with appropriate supports. However, without knowing all the reasons, perhaps we can agree that the performance profile of three of the four students provide clear evidence of a performance problem. The trend line is clear whether the data are captured over five days or five weeks: three of the four students are failing to perform as expected.

D's Algebra Performance

L's Algebra Performance

K's Algebra Performance

T's Algebra Performance

Unfortunately, schools have been failing large numbers of students long before NCLB was around. The problem is not about performance standards. Rather, do we have a responsibility to do more than simply fail students that are not benefiting from the current model of one-size-fits-all instruction? If a student has repeatedly failed, how much failure data do we need before we have enough evidence that the student can't perform the task? When do we intervene? (Edyburn, 2006a, 2006b).

When to Intervene?

How long do we allow students to fail at a given task before we determine they need assistive technology in order to perform the task as expected? Poor academic performance should be a trigger for assistive technology consideration. Consider the following two scenarios (adapted from Edyburn, 2007):

Scenario 1

Event: A child working on the family farm has an unfortunate accident with a combine and loses his right arm.

Response: Due to the response by the local paramedics and excellent treatment at local medical facilities, the physical wound is treated quickly. However, the trauma, loss, and grief will linger for the child and his family. When the child returns to school, if the child was right handed, is it reasonable for his teacher to expect that he will write his name the same way he did before the accident?

Of course not. His right arm and hand are no longer available for completing the simple task of writing his name on his papers. In situations like this, the child typically receives occupational therapy services where he is taught a variety of interventions to compensate for the physical limitations he may encounter. For example, he may learn how to write with his left hand, how to keyboard with one-hand, how to use a speech recognition system, and how to use a rubber stamp so that he can quickly sign his name.

Scenario 2

Event: A child comes to school not being able to read.

Response: Despite the best efforts of his teachers, the child is slow to recognize the letters of the alphabet. He has great difficulty in learning the sounds each letter makes. His knowledge of sight words is minimal. He has limited interest in looking at books or listening to stories. By the time the child reaches fourth grade, his reading skills have advanced to a level equivalent of a mid-year first-grade student. Year after year, the child, his parents and teachers have tried new instructional approaches; used a variety of instructional materials; devoted extra time to reading activities; engaged peer readers to work with him; and used a host of motivational techniques to model, reward, and even coerce him to read. Despite everyone's best efforts, the child has not developed the reading skills that allow him to derive meaning from text with adequate speed, fluency, and comprehension.

I believe these two scenarios are instructive because many educators fail to see any relation between the responses to the challenges each student experiences. For example:

- In the first scenario we notice the obvious physical impairment demands an immediate response. However, in the second scenario, four years have been devoted to teaching a child to read with little evidence of success.

- We recognize that it would be cruel and unacceptable to demand that a child write with his right arm after it has been lost, but we feel no remorse in demanding that struggling children read like their normally achieving peers, despite having years of failure data that indicate that they cannot do the task.

• We often fail to notice the double standard we hold. In the first case, there is little interest in how the child completes the task; the emphasis is on functional performance. In the second case, we insist that the only way to read is by using the same visual, perceptual, and cognitive functions as everyone else, despite a plethora of data that points to an impairment in those organic systems.

In each scenario it is important to consider the event that stimulates an intervention and associated support services. Such issues are clear in the first example. However, in the second scenario, there is no single event that triggers action. Therefore, how long do we continue to provide reading instruction when a child is clearly not benefiting from instruction? The point is not meant to suggest that we give up teaching a child to read. Rather, how do we identify trigger events that clearly indicate it is time to switch tactics in order to overcome functional performance problems? For students with mild disabilities, there is no single event that triggers the provision of assistive technology interventions.

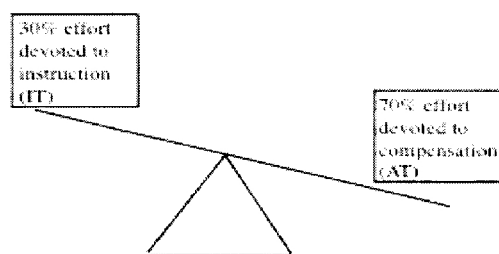## Calculating the Remediation vs. Compensation Equation

Particularly problematic is a decision implicit in the assistive technology consideration process: remediation vs. compensation (Edyburn, 2002). That is, how do we decide if the best course of action is remediation (i.e., additional instructional time, different instructional approaches) versus compensation (i.e., recognizing that remediation has failed and that compensatory approaches are needed to produce the desired level of performance)? Because the question is implicit, it seldom discussed explicitly as part of the assistive technology consideration process.

Assistive technology theorists (Cook & Hussey, 2002; King 1999) suggest we have a critical decision to make: remediate or compensate. Perhaps it is not coincidental that these writers are therapists by training and thus are used to making decisions about physical performance. For example, if I cannot complete certain tasks without my right arm, additional therapy may be an option if I am recovering from surgery, but not an option if I've had an amputation. Certainly, the benchmarks to guide decision-making about remediation and compensa-

tion are much clearer in situations involving mobility and sensory impairments. Unquestionably, compensatory approaches are often used because there are simply no other ways to complete the task.

Teachers are extremely comfortable with the options associated with remediation: reteach the information, use alternative instructional strategies, break the tasks down into smaller parts to analyze what the child knows and what components are problematic, reduce the number of items that must be completed, provide additional practice, engage in one-on-one tutoring, etc. However, if instruction and remediation approaches always worked, we would never see secondary students struggling with developmental tasks like decoding, solving basic math facts, and handwriting that interfere with higher level performance.

Edyburn (2002) has suggested that one means of addressing the remediation vs. compensation problem is to consider the R vs C decision to be a complimentary equation rather than either/or decision. That is, IEP teams should ask the R vs C question as part of the assistive technology consideration process and seek to determine (1) what percentage of time and effort should be devoted to instruction/remediation and (2) what percentage of time and effort should be devoted to compensation.

The R vs. C Equation requires the team to consider the compatible issues of challenge vs. frustration and instructional skill building vs. performance support. The allocation of time and effort (e.g., R=30%, C=70%) can be adjusted over time as the IEP determines whether the compensatory uses of technology are producing the desired level of successful performance. The R vs. C Equation is likely to be a critical factor in enabling students with mild disabilities to achieve grade level content standards. However, another critical question awaits: What do we do?

Locating Technology Interventions With the Potential to Enhance Academic Performance

When students with mild disabilities are unable to achieve the academic and behavior goals that are set for them, at some point in the educational process, we must recognize the need to provide technology tools and supports that will enable them to successfully complete the required tasks (Edyburn, 2005b). For example, if a known characteristic of a disability is that a student has difficulty processing and retrieving factual information, then why doesn't the IEP team's consideration of assistive technology result in the recommendation of the web search engine, Ask for Kids (http://www.askforkids.com)? Functionally, this would allow a student to look up the answer to anything he doesn't know.

Once educators recognize a performance problem, they must determine how to respond. Unfortunately, I am not sure our current store of research validated interventions is stocked with all the tools we need. Consider the following instructional difficulties and the innovative performance support solutions:

• For students unable to independently read their textbooks, provide digital text and text-to-speech software such as ReadPlease (http://www.readplease.com) or Kurzweil 3000 (http://www.kurzweiledu.com) or Read and Write Gold (http://www.texthelp.com) or Solo (http://www.donjohnston.com) so that the student can listen to the information as it is read by the computer.

• For students that struggle with the physical and mechanical tasks of generating a first draft of a paper, provide a dictation service such as iDictate (http://www.idictate.com) that charges 1.5 cents per word to prepare documents based on dictation provided over the telephone.

• For students with computational difficulties in math provide WebMath (http://www.webmath.com). This web-based tool provides calculating and instructional support for solving math problems from elementary through graduate school.
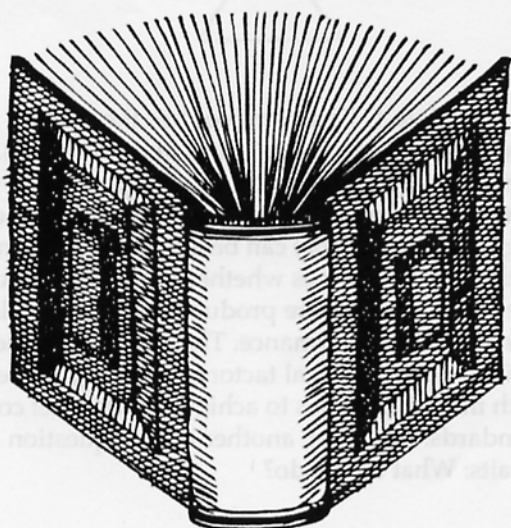
If we are going to ensure the success of all students, we must be much more comitted to locating resources, strategies, and tools that support academic performance. The Table on the next two pages outlines a number of interventions of assistive and instructional technology that may have the potential to enhance the academic performance of students with mild disabilities.

Understanding the Role of Technology to Enhance Performance

A significant problem that has yet to be adequately addressed in the literature concerning assistive technology for students with mild disabilities focuses on our assumptions about the role of technology to support learning and performance. As a result, there is much confusion about why, how, and when technology should be used by struggling students. Let's briefly examine some of the issues.

Issue: We should not allow a student with a disability to use assistive technology, such as a spelling checker or reading machine, because they will not be able to use these tools on high stakes tests.

Response: To-date, most forms of assistive technologies have been banned from use on standardized tests due to concerns about their influence on test scores. These arguments are quite similar to the same argument that arose 30 years ago relative to calculators. Little headway was made until educators and test developers recognized that calculators were ubiquitous and still required the user to know how to operate the calculator to derive the correct answer. If history is any guide, we have about another 20 years of waiting before this problem is

solved. In the meantime, do we deprive students what they need for 175 days simply because they can't use assistive technology for five days of standardized testing?

Issue: Allowing a student with a disability to use assistive technology is cheating because the student really can't do the task.

Response: Education places a premium on knowledge that is contained in one's head. Performance that is completed without the aid of external devices and resources is prized over performance that is dependent on tools or resources. While this may be a historical artifact of society's conception of the educated person, there is a clear bias here. Assistive technology outcomes researchers have termed this form of bias, "naked independence," as it exults the performance of able-bodied individuals and devalues the performance of others that must rely on external devices or tools (Edyburn, 2003b). Hehir (2005) observes that most people value intrinsic spelling ability and devalue the performance of those individuals who rely on spelling checkers. He calls this situation "ableism," and argues that it is an insidious form of discrimination that creates barriers for individuals with disabilities based on the cultural attitudes of the able-bodied.

Issue: Allowing a student with a disability to use assistive technology would not be fair to other students.

Response: This issue involves two components. On the surface it appears to be a concern about fairness. However, it represents an arrested level of development about what fairness means. It argues from the perspective of a kindergarten child who believes fairness means that everyone gets the same thing. Actually, fairness means everyone gets what they need (Welch, 2000). However, the deeper subtext involved in this statement has social justice implications. That is, the implication of naked independence and the desire to maintain the privilege and status held by non-handicapped students that complete a task without external aids.

Issue: If we allow a student with a disability to use assistive technology, when will they ever learn to complete the task?

Response: This statement is absurd in the context of physical and sensory disabilities: denying a child a wheelchair because he will never learn to walk;

denying a blind child a screenreader because he will never learn to read. However, this line of reasoning is all too common in the area of speech and language disabilities and disabilities that involve cognition. That is, if we give a child an augmentative communication device when will he learn to speak intelligibly on his own? Likewise, if we give a child assistive technology that reads to him, when will he learn to read? We need to understand the difference between technologies that serve a scaffold function that is used for a period of time and then discarded (e.g., crutches after an ankle sprain) vs. technologies that will be life long companions to compensate for a disability (e.g., a screen reader used by a blind student).

Issue: If we allow a student with a disability to use assistive technology, aren't we making the task too easy and making them dependent rather than independent?

Response: This question encompasses several issues: conceptions of learning, challenge, and development of expertise. If a task is too easy we become bored. If a task is too hard we avoid it because we have little likelihood for success. What students at all grade levels and all ability levels need are tasks that are at appropriate levels of challenge. The research on learning is very clear that all learners seek optimal challenge. Concerns that some students will always seek the easiest level are misguided and often used to argue against providing learning supports for students who struggle. However, the research on learning is very clear about the process for developing expertise. That is, learners only achieve high levels of expertise as a result of sustained engagement, over time, with tasks that are increasingly challenging and personally rewarding. When a student uses assistive technology to engage in a learning task, they are afforded the opportunity for access and participation. If the learning experience is positive, there is the possibility they will continue to engage in the task. In time, we will learn if the technology serves as a tool for simply providing access and is then discarded or if the tool serves as a life-long performance support tool. Interestingly, people do not seem to discard their word processor, TiVo, or cruise control after they learn how to use these technologies. It seems we are confused about the double-standard we hold: technology is school should be withheld so that tasks are difficult but technology in real-life should be adopted whenever they make certain tasks easier.

Issue: I have high standards... students have to complete my assignments without the assistance of any assistive technology. I am preparing students for the real world; when they get out there they will be expected to complete these tasks without any assistance.

Response: This argument seeks to cloak the person in the unassailable blanket of high standards. Actually, outside of school there are many ways to complete a task. Consider the task of balancing a checkbook. I can maintain my balance using mental math to do the subtractions after I write each check. Or, I can use a calculator. Or, I can have my spouse balance the checkbook. Or, I can use online banking and never have to engage in the subtraction or addition process at all. Technology provides more options than ever before. A teacher advancing an argument against assistive technology on the basis of holding students to high standards is really arguing for maintaining the status quo. That is, when a one-size-fits-all curriculum and instruction model is implemented what varies is student performance (i.e., some students will achieve the instructional goal and many will not). However, when high standards are the focus, what varies are the supports and tools necessary for each student to achieve the expected high level of performance.

Assessing Claims of Technology Enhanced Performance

The immense size of the mild disabilities population has caused a certain level of paralysis within the field that has prevented systematic efforts to address their assistive technology needs. That is, administrators are reluctant to approve requests for assistive technology for students with mild disabilities because there are many more students like them in every building. If they say yes to one, how will they say no to the others? As a result, it is absolutely essential that the field understand the importance of measuring claims of technology enhanced performance in order to collect and evaluation the evidence necessary to document whether the desired goal is being achieved. Decision models like one developed by Dyck and Pemberton (2002) concerning how to determine who needs text modifications is essential for the field to discern who can benefit from an intervention and who cannot.

Assistive technology researchers have created a research design known as the Time Series Concur-

rent and Differential (TSCD) Approach as a means of collecting evidence about the impact of technology on performance (Smith, 2000). Essentially, the research design involves a series of performance measures of an individual when s/he is completing a specific task, with and without the technology (aided vs unaided performance). Graphing the data over a period of time will reveal patterns of performance that serve to establish the impact of the technology. Readers interested in learning more about the application of this methodology may wish to explore its application in reading (Edyburn, 2004), writing (Edyburn, 2003c), math (Edyburn, 2003b), and science (Edyburn, 2006c).

Considerable work remains to be done concerning the measurement of claims of technology enhanced performance. One significant problem centers on the lack of performance measurement tools for assessing academic progress. As a result, teachers are expected to make their own assessments, as well as score them, graph the data, and draw conclusions.

Concluding Thoughts

The purpose of this article was to provide a brief introduction to the use of assistive technology by students with mild disabilities. If the dawn of this specialty area can be traced to 1997, it is clear that some progress has been made in the past ten years. However, there is little evidence to suggest that all students with mild disabilities have access to appropriate assistive technologies. As a result, the field must urgently initiate efforts to reach the underserved and unserved. In addition, leadership is needed to develop appropriate policies and practices relative to three phases of the assistive technology process: consideration, intervention, and outcome. It is also important to empower individuals and organizations to identify new interventions that will enhance the academic and behavioral performance of students with mild disabilities in ways that fully compensate for their disabilities. Finally, it is essential that the field engage in collecting and evaluating data to determine the efficacy of the interventions in order to understand the effort and cost necessary to scale-up the benefits.

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